Learning from the past –
An online Database of European Drought Characteristics and Impacts

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Current conditions – Prec and Temp anomalies
Outline

• EDII – European drought Impact report Inventory
  – What is it?
  – How to collect & archive?

• Analyzing Impact reports
  – Differences across regions
  – Linking impacts to drought indicators and risk analysis

• EDC and EDR database

• How to move forward
Reported drought impacts across Europe:

**Definition:** negative consequences for environment, society or economy

Sources differ by region and change over time!
Water Supply

At the waterworks “Ebnet” well site, groundwater level has dropped below the threshold for abstraction (…). Therefore water is now pumped from the “Hausen” wells to Freiburg (…)

Ecosystems

(….) trees shed leaves (…)

Agriculture

(…) corn crops are most heavily affected. On many fields plants have not produced cobs (…)

Forestry

(…) Effects in growth reduction expected (…)

→ not (yet) ‘drought impacts’ acc. to our definition!!!

Forest Fire

(…) high forest fire danger…
Archiving impact reports: overview

- Collection is tedious
+ Textual evidence links cause (drought) and effect (impact)
+ - Coding guarantees consistency, but restrictive \(\rightarrow\) keep Text!
The impact coding scheme

- **Main impact “categories”**
- **Impact sub-types**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; Livestock f.</td>
<td></td>
</tr>
<tr>
<td>Forestry</td>
<td></td>
</tr>
<tr>
<td>Aquacultures &amp; Fisheries</td>
<td></td>
</tr>
<tr>
<td>Energy &amp; Industry</td>
<td></td>
</tr>
<tr>
<td>Waterborne transport.</td>
<td></td>
</tr>
<tr>
<td>Tourism &amp; Recreation</td>
<td></td>
</tr>
<tr>
<td>Public Water Supply</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td></td>
</tr>
<tr>
<td>Freshwater ecosystems</td>
<td></td>
</tr>
<tr>
<td>Terrestrial ecosystems</td>
<td></td>
</tr>
<tr>
<td>Soil systems</td>
<td></td>
</tr>
<tr>
<td>Wildfires</td>
<td></td>
</tr>
<tr>
<td>Air quality</td>
<td></td>
</tr>
<tr>
<td>Human Health &amp; Public S.</td>
<td></td>
</tr>
<tr>
<td>Conflicts</td>
<td></td>
</tr>
</tbody>
</table>

- **Note**: developed as part of the international project DROUGHT-R&SPI; reflects on the special requests from individual countries
Welcome to the EDII and EDR database

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- To submit a drought impact report: [Click Here]

Comments and Suggestions

We are working hard to improve the function of this site and appreciate any recommendations or comments. Please, click to the left to submit a comment or suggestion.
How to query the EDII database

European Drought Centre

Search the EDII Database

Please make your selections and impacts in the EDII database will be returned that match your search parameters. You can make multiple selections by using the Shift or Ctrl keys.

Time
Choose:
- Drought Event(s):
  - Any — 0003 1913 Scandinavia 1914 Scandinavia 1930 Norway 1933 Norway 1940-1942 Finland 1947 Scandinavia 1984 Denmark
- Year(s):
  - Any — 1904 1907 1908 1913 1914
- Date Range:
  - Month / Year
  - and -
  - Month / Year

Location
Choose:
- Country:
  - Any — All European countries Belgium-Belgium Belgium-Czech Republic
- NUTS Region:
  - NUTS1
  - NUTS2
  - NUTS3

Impact
Choose:
- Impact Category:
  - Any — Agriculture and Livestock Farm Forestry Freshwater Aquaculture and Fisheries Energy and Industry Waterborne Transportation
- Impact Type:
  - Any — Agriculture and Livestock Farm Forestry Freshwater Aquaculture and Fisheries Energy and Industry Waterborne Transportation
- Associated Impact:
  - Any — Agriculture and Livestock Farm Forestry Freshwater Aquaculture and Fisheries Energy and Industry Waterborne Transportation
- Cost (Euros):
  - Minimum — Maximum

Submit an Impact Report

Submit
Start Over
EDII – Example Germany

European Drought Impact Inventory Query

Results of your drought impact query are shown below. Number of results: 12/10

Impact Map

The following map shows the location of all drought impact reports that match your search terms. Countries with the most impacts are shown in dark blue, while countries with few reports are shown in light blue. Scroll your cursor over the country or point impact to find more information.

Impact Details

Impact details are shown below. Table can be sorted by an column by clicking on the header. Also, the results can be searched using the search bar in the top left.
### Impact Details

Impact details are shown below. Table can be sorted by a column by clicking on the header. Also, the results can be searched using the search bar in the upper right.

<table>
<thead>
<tr>
<th>Drought Event</th>
<th>Country</th>
<th>Start Date</th>
<th>End Date</th>
<th>Impact</th>
<th>Impact Category</th>
<th>Impact Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904 Central/Western Europe</td>
<td>Deutschland</td>
<td>1904</td>
<td></td>
<td>1.1</td>
<td>Reduced productivity of annual crop cultivation, crop losses, damage to crop quality or crop failure due to dieback, premature ripening, drought-induced pest infections or diseases etc.</td>
<td>The summer of 1904 was characterized by both extreme drought and heat. The anomaly dry period beginning in May and continuing until September impacted agriculture heavily. The fruitification and harvest of grain crops were 4-5 weeks earlier than usually with low yields and of bad quality. Field vegetables and fodder crops withered, especially potatoes featuring large damage. Clover (green fodder) and hay meadows desiccated so that the second cut failed and a shortage of fodder developed which threatened livestock extremely.</td>
</tr>
<tr>
<td>1904 Central/Western Europe</td>
<td>Deutschland</td>
<td>1904</td>
<td></td>
<td>1.2</td>
<td>Reduced productivity of annual crop cultivation, losses &gt; 36% (EU compensation threshold)</td>
<td>The summer of 1904 was characterized by both extreme drought and heat. The anomaly dry period beginning in May and continuing until September impacted agriculture heavily. The fruitification and harvest of grain crops were 4-5 weeks earlier than usually with low yields and of bad quality. Field vegetables and fodder crops withered, especially potatoes featuring large damage. Clover (green fodder) and hay meadows desiccated so that the second cut failed and a shortage of fodder developed which threatened livestock extremely.</td>
</tr>
</tbody>
</table>
Overview of Drought Impacts
Impacts in SE-England in 2011-12

1-2/2012: Fish deaths and distress in River Meon and a lake in Hampshire. 30 mature sea trout and 6 salmon reported dead.

3/2012: In some regions in the east and south east of England several domestic wells dried up.

4/2012: 7 water companies in the south and east of England imposed temporary water use bans on 20 million customers.
European scale: impacts of historical events

Pan-European events

Impact Start
- month
- season

Regions
(with $\geq 1$ DI)
- Country
- NUTS-1
- NUTS-2
- NUTS-3

Reported impacts per Category
- Recreation and tourism
- Conflicts
- Human health and public safety
- Energy and industry
- Waterborne transportation
- Public water supply
- Water quality
- Freshwater ecosystems
- Aquaculture and fisheries
- Soil system
- Terrestrial ecosystems
- Forestry
- Forest fires
- Agriculture and livestock farming

→ all impacts during ‘big’ droughts, more specific during regional droughts

1975/76
2003
2011/12
Space: relative importance of impacts

Relative freq. of reported category in each country

0%
100%
Submit an impact - EDII

EDC EUROPEAN DROUGHT CENTRE

Submit a Drought Impact

Successful login! Welcome, edcuser.
You have contributed 0 unique impact reports, which include 0 impacts. Thank you very much for your support.

Basic Information

Select Information Source:

Type or click here

Editor Name:
EDC User

Reference:

Type or click here

Submit

Discard
Submit a Drought Impact

Use this page to submit drought impacts to the Drought Impact Inventory. Click on the icon for help.

Impact Location

Please first select one or more countries.

Select Country: You cannot choose more than 1 item
- Deutschland

Select NUTS 1 Region:
- Baden-Württemberg

Select NUTS 2 Region:
- Freiburg

Select NUTS 3 Region:
- Freiburg im Breisgau, Stadtkreis

Select River or Stream:
- Dreisam – mit Quellfluss Rotbach – (Elz)

Select Lake or Reservoir:
- Type or click here

Longitude:
- Degrees (decimal)

Latitude:
- Degrees (decimal)

Altitude:
- (m ASL)

Location Details:

Waterworks Ebnet - Freiburg in Germany, river Dreisam,
Impact Duration

Please select between month or season and year

Date of Impact Start
- Month: 8
- Season: Type or click
- Year: 2015

Date of Impact End
- Month: Mont
- Season: Type or click
- Year: Year

Related Drought Event

Select Drought Event: 2015 drought central Europe

You cannot choose more than 1 item
Impact Details

Select Impact Category:
Public water supply

Select Impact Type:
Local water supply shortage / problems (d

Impact Description:
Groundwater reservoir levels are down to minimum, public water supply cannot be guaranteed from this reservoir anymore.

People Affected:
Number of people

Area Affected (ha):
Area (ha)

Economic Loss by Impact (€):
Loss (€)
Additional Information

- Additional information is available

Click to add entries - multiple entries are possible - add one by one

Associated Indirect/Secondary Impacts

Associated Impacts:

- Type or click here

Associated Impact Description:

If additional information on associated impacts and/or response measures is available in the report, please tick the checkbox above.

Response

Type of Measures:

- Water supply management

Administrative Level of Measures:

- local activities

Related Costs (€):

- Response costs

Response Description:

- Import of water from different water reservoir (Hausen)
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Analyses of reported impacts - options

Vulnerability Assessment, Anecdotal evidence, Illustration, etc.

Temporal profiles

Impact likelihood as a function of hazard (hydrometeorological drought index)

Spatial profiles

EDII-Text
eamples of drought narratives see EDR database

EDII-Coded Data

Risk as a function of hazard (hydrometeorological drought index) and vulnerability (evidence by impact)

EDII – Impact and Risk Analysis
Linking impacts to indices

**Impact functions (data driven empirical models)**
- as a step towards damage or vulnerability functions for risk quantification
- to predict impact likelihood

![Diagram showing link function between hazard intensity and damage variable.](image)
Management: best-predictors for impacts

- Combination of long and short accumulation times
- Seasonality may matter

**Table 3**

Summary of drought impacts

<table>
<thead>
<tr>
<th>Category</th>
<th>SI 12/SPEI 12***</th>
<th>SI 12/SPEI 12***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>★★</td>
<td>★★</td>
</tr>
<tr>
<td>Energy and industry</td>
<td>★★</td>
<td>★★</td>
</tr>
<tr>
<td>Water supply</td>
<td>★★</td>
<td>★★</td>
</tr>
<tr>
<td>Freshwater ecosystems</td>
<td>★★</td>
<td>★★</td>
</tr>
</tbody>
</table>

Fig. 6. Agricultural drought impacts: SPI2/SPEI2 interaction term for Slovenia. Predicted impact likelihood is shown in color, with red corresponding to high likelihood (≈100%) and blue corresponding to low likelihood (≈0%). Percent likelihood is also shown as contour labels. (For interpretation of the references to
Lessons and challenges of impact report data

EDII: data collection and coding

• Categorization scheme works, but is very detailed and thus time-consuming to fill in
• Data entries & coding should preferable be ‘moderated’
• Challenge: sources and vulnerability change in time

Analyses & Modelling

• Large diversity of drought impacts across regions and events
• Potential for risk analysis is high - as for many sectors there is limited (other) quantitative data on damage and impacts available
• Challenge: no data ≠ no impact occurrence
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## Summary of Major European Droughts

The EDR database site is compiled as part of the EU funded DROUGHT RISE Project. The database is designed to provide a single, publicly available site to disseminate detailed information about historical drought events in Europe. For additional information on this project and data collection, see the Project Overview. Major European droughts identified by the EU funded DROUGHT RISE Project are listed below. Links provide detailed meteorologic and hydrologic drought indices, as well as information regarding economic, social, and environmental impacts.

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Summer</th>
<th>Winter</th>
<th>Climatological (SPI-6)</th>
<th>Hydrological</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Approx. Duration</td>
<td>Peak Date</td>
<td>Area (%)</td>
<td>Area (10^6 km²)</td>
</tr>
<tr>
<td>1950</td>
<td>Northern Europe</td>
<td>5/1950-2/1956</td>
<td>17/10/1959</td>
<td>52.6</td>
<td>3,000</td>
</tr>
<tr>
<td>2000</td>
<td>East/Southeast Europe</td>
<td>1/2001-3/2001</td>
<td>23/1/2001</td>
<td>30.5</td>
<td>2,201</td>
</tr>
</tbody>
</table>
Drought of 1973

Central Europe

Drought Event Summary

The 1973 drought event was a spring drought, related to low winter precipitation. It was not as severe when compared to other droughts in the record, but was extensive, affecting much of central Europe and parts of the Iberian peninsula.

The drought peak is not particularly well defined, but occurred between March and April of 1973 in Great Britain, France, Germany, and southern Scandinavia. Drought conditions began to retreat by May 1973 for much of Europe.

Following this, a more isolated drought developed, affecting Scandinavia in late summer and early fall. Because of this, the maximum extent of climatological drought occurred in March 1973, differing from the meteorological drought peak, which occurred the following November in Scandinavia.

Climatological Drought

In winter of 1972, a high pressure ridge stretched east-west across Europe causing low precipitation in central Europe. By March this ridge had shifted towards the British Isles, producing the most severe precipitation shortages there. This blocking effect continued, resulting in low rainfall across a wide region of central Europe by April 1973.

Progression of climatological (SPI-6) drought. Climatological drought is defined by the SPI-6, which sums precipitation over the previous 6 months and transforms this value to the standard normal distribution. Negative SPI values (shown in red) represent dry conditions, measured in standard deviations from typical conditions. Percent area in drought is calculated by summing all cells less than the 20th percentile (SPI < -0.84).
EDR - SPI by date

Standardized Precipitation Index (SPI) by Date

User can query the EDR database of SPI values within Europe. Currently this tool is limited to SPI-6 (6-month accumulated precipitation), but will soon be expanded to include alternative accumulation periods and the Standardized Precipitation Evapotranspiration Index (SPEI).

Select start and end dates. SPI maps may be played as a movie or paused to view a single day.

<table>
<thead>
<tr>
<th>Index</th>
<th>Accumulation</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI</td>
<td>6 Month</td>
<td>8 / 10 / 2005</td>
<td>8 / 20 / 2005</td>
</tr>
</tbody>
</table>

Time Step

Daily

Submit

Animation showing the SPI-6 map For a custom interval
I have been researching hydrological drought for more than 10 years. I have a broad interest and worked around the world, from Norway to Spain, from Mexico to Chile, from Turkey to Vietnam, from Kenya to South-Africa. In my PhD and postdoc, both at Wageningen University (the Netherlands), I investigated the propagation from meteorological to hydrological drought in different climates and catchments. Since 2016 I work as a lecturer at the University of Birmingham (UK), where I have set up a drought research group with two postdocs and three PhD students. Currently, my main focus is on drought in the Anthropocene. I study the feedbacks between drought and society, i.e. the influence of human activities on drought and the response of society to drought impacts.
Hydrological Drought – 1st Edition


Single chapters are downloadable from the following links:

- Preface
- Acknowledgments
- Contributors
- Contents
- Brief Contents
- Contents CD

IMPORTANT: not all chapters are already available, but we will publish as soon as possible.
EDC - statistics

- Around 100 single visitors each day
- Increasing position in search engines
- Most visited pages
  - Standardized Climate Indices
  - Video for the Drought Day 2016 (Henny van Lanen lecture)
  - Textbook on Hydrological drought – download page
  - Software from the book
  - EDII
EDII Statistics - 2016

- Almost 1500 sessions from 72 countries (top 25 countries listed in the pie chart)
- An average of 100 unique users/month
- More than 4000 pages visited

Most viewed pages:

- Impact Search
- Drought Event Summary
- Home Page
- Impact Search Results
- SPI Tool
- Login Page
- Submit Impacts

Pie chart showing top 25 countries with the highest user sessions.
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Future of the EDII

CA: from project prototype to community resource:

• Data base
  – Professional technical assistance and development
  – Host institution
  – Visualisation tools

• Moderator
  – Quality control of impact entries (personell)
  – Webmaster/Contact person

• Research
  – Joint resource supporting EU collaboration
  – Further development (database, methodology and applications)
  – Can potentially provide Impact based forecasts and projections
References

EDII database, guidelines document, paper

- www.geo.uio.no/edc/droughtdb/

Applications of EDII data


